# SECTION 206 PROGRAM AQUATIC ECOSYSTEM RESTORATION

# MILL RIVER AND MILL POND HABITAT RESTORATION PROJECT STAMFORD, CONNECTICUT

# **DETAILED PROJECT REPORT**

August 2004



New England District

### MILL RIVER AND MILL POND RESTORATION STAMFORD CONNECTICUT DETAILED PROJECT REPORT

## TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
TABLE OF CONTENTS	viii
SECTION 1. INTRODUCTION	1
1.1 STUDY AUTHORITY	1
1.2 STUDY PURPOSE AND SCOPE	1
1.3 STUDY AREA	2 5
1.4 STUDY PROCESS	5
1.5 HISTORY OF DAM CONSTRUCTION	5
1.6 RESTORATION OF HISTORIC FISH MIGRATION CORRIDOR	8
1.7 NON-FEDERAL SPONSOR INVOLVEMENT IN THE STUDY	8
SECTION 2. PROBLEMS AND OPPORTUNITIES	9
2.1 EXISTING CONDITIONS	9
2.2 PROBLEM IDENTIFICATION	12
2.3 ECOSYSTEM RESTORATION OPPORTUNITIES	16
2.4 PROJECT GOAL AND OBJECTIVES	17
2.4.1 Project Goal	17
2.4.2 Project Objectives	17
2.5 CONSTRAINTS	17
SECTION 3. INVENTORY AND FORECAST OF CONDITIONS	18
3.1 INTRODUCTION	18
3.2 SITE CHARACTERIZATION	18
3.2.1 Data Collection	20
3.2.2 Data Analysis and Results	21
3.2.3 Hydrographic Survey and Site Mapping	21
3.2.4 Hydraulic Analyses	21
3.2.5 Water Quality	23
3.2.6 Sediment Quality	24
3.2.7 Benthic Environment	26
3.2.8 Fisheries, Shellfish, and Threatened and Endangered Species	26
3.3 FUTURE-WITHOUT-PROJECT CONDITIONS	27
SECTION 4. FORMULATING ALTERNATIVE PLANS	28
4.1 OVERVIEW OF PLAN FORMULATION PROCESS	28
4.2 IDENTIFYING RESTORATION MEASURES	28
4.2.1 City of Stamford's Greenway Planning	33
4.2.2 Watershed Best Management Practices	33

4.2.3 Identified Restoration Measures	34
4.3 FORMULATION OF ALTERNATIVES	36
4.3.1 Alternative 1: No Action	36
4.3.2 Alternative 2: Dam Removal and River Channel Restoration	36
4.3.3 Alternative 3: Dam Removal and Creation of Step Pools	41
4.3.4 Alternative 4: Partial Removal of Concrete Retaining Walls	43
SECTION 5. EVALUATION OF ALTERNATIVES	46
5.1 INTRODUCTION	46
5.2 HYDRAULIC AND SEDIMENT TRANSPORT EVALUATION	46
5.2.1 Background	47
4.2.2 Summary	47
5.3 ENVIRONMENTAL EVALUATION	51
5.3.1 Environmental Evaluation of Removing the Main Street Dam	
(Alternatives 2 and 3)	51
5.3.2 Environmental Evaluation of Alternative 4	52
5.4 GEOTECHNICAL EVALUATION	53
SECTION 6. COMPARISON OF ALTERNATIVES	54
6.1 INTRODUCTION	54
6.2 COMPARISON OF ENVIRONMENTAL BENEFITS	54
6.3 COMPARISON OF COSTS	57
6.4 INCREMENTAL ANALYSIS	59
6.4.1 Comparing Habitat Output	60
6.4.2 Incremental Cost Analysis	60
6.4.3 National Economic Development Benefits Account	63
6.5. RECOMMENDATIONS	63
SECTION 7. DESCRIPTION OF RECOMMENDED ALTERNATIVE	66
7.1 DESCRIPTION OF THE RECOMMENDED PLAN	66
7.1.1 Mill River Park Ecosystem Restoration (Sites 12 and 13)	71
7.1.2 Landscape Design and recreational Components	77
7.1.3 Tidal Wetland Restoration	78
7.1.4 Riparian Corridor Restoration	81
7.1.5 Removal of Obstruction at Pulaski Street Bridge	83
7.2 DESIGN ASSUMPTIONS	84
7.3 PRELIMINARY CONSTRUCTION REQUIREMENTS	85
7.4 MONITORING	86
7.5 OPERATION AND MAINTANENCE	87
7.6 REAL ESTATE REQUIREMENTS	87
7.7 TOTAL PROJECT COST ESTIMATE	88
SECTION 8. PROJECT IMPLEMENTATION	91
8.1 NON-FEDERAL SPONSOR	91
8.2 PERMITS REQUIRED	91
8.3 PROJECT COST SHARING AND APPORTIONMENT	91

8.4 NON-FEDERAL COOPERATION REQUIREMENTS	92
8.5 FINANCIAL ANALYSIS	94
SECTION 9. SCHEDULE FOR ACCOMPLISHMENTS	97
SECTION 10. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS	98
10.1 FINDINGS AND CONCLUSIONS	98
10.2 RECOMMENDATIONS	99
SECTION 11. REFERENCES	100
LIST OF FIGURES	
Figure 1. The City of Stamford and the Rippowam Basin, New York and	
Connecticut	3
Figure 2. Project Area within the City of Stamford	4
Figure 3. Historical Plan of the Mill Pond and Main Street Dam (1922)	7
Figure 4. Existing Site Plan and Topographic Survey of Mill River Park	11
Figure 5. FEMA Cross-Section Locations within the Project Area	19
Figure 6. Bathymetric Survey of Mill Pond	22
Figure 7. Locations of Potential Restoration Actions	31
Figure 8. Aerial Photo of Locations of Potential Restoration Actions	32
Figure 9. Alternative 2 Concept – Dam Removal and River Channel Restoration Figure 10. Conceptual Plan for Creation of Freshwater Wetland at JM Wright	39
Technical School	40
Figure 11. Alternative 3 Concept – Dam Removal and Step Pool Creation	42
Figure 12. Alternative 4 Concept – Partial Removal of Concrete Retaining Walls	44
Figure 13. Water Surface Profiles for the 100-Year Frequency Discharge	48
Figure 14. 100-year Floodplain Boundaries with and without Main Street Dam	49
Figure 15. Recommended Mill River Restoration Locations (Sites 1, 2, and 6)	68
Figure 16. Recommended Mill River Restoration Locations	
(Sites 9, 10, 11, 12, and 13)	69
Figure 17. Recommended Mill River Restoration Locations (Site 18)	70
Figure 18. Proposed Restoration and Dam Removal within Mill River Park	72
Figure 19. Cross-Sections of Proposed Restoration within Mill River Park	73
LIST OF TABLES	
Table 1. Data Results Summary for Mill Pond Sediment Sampling	25
Table 2. Potential Projects Identified During Field Investigations	30
Table 3. Components of the Restoration Alternatives	45
Table 4. Comparison of Alternatives Using Anticipated Habitat Value	56
Table 4a. Comparison of Additive Measures Using Anticipated Habitat Value	56

Table 5. Federal Project Restoration Features of Each Alternative	57
Table 6. Estimated Project Costs for Each of the Alternatives and	
Additional Measures	58
Table 7. Restoration Measures Cost and Output	61
Table 8. Cost-Effective Plans	62
Table 9. Incremental Cost Curve of Best Buy Plans	62
Table 10. Recommended Restoration Actions	67
Table 11. Potential Tree Species for Floodplain within Mill River Park	75
Table 12. Potential Herbaceous and Shrub species for Bank Stabilization	
and Floodplain	76
Table 13. Potential Plant Species for Tidal Wetland Area Restoration	80
Table 14. Potential Plant Species for Riparian Enhancement	81
Table 15. Preliminary Cost Summary for proposed project	89
Table 16. Proposed Project Construction Costs	90
Table 17. Cost Sharing of Total Project Costs	95
Table 18. Non-Federal Requirements of Total Project Costs	96
Table 19. Federal Funding Needs	96
Table 20. Mill River and Mill Pond Habitat Restoration Schedule Summary	97
LIST OF PLATES	
Plate 1. Mill Pond and Mill River Park	9
Plate 2. Main Street Dam	10
Plate 3. Failing sluice gate of the Main Street Dam	12
Plate 4. Cracked retaining wall of the Mill Pond impoundment	13
Plate 5. Mill River Park with cherry trees in full bloom	14
Plate 6. Damaged Cherry Tree in Mill River Park	16
Plate 7. Area dominated by <i>Phragmites</i> within tidal reach of Mill River	79
Plate 8. Concrete Obstruction under Pulaski Street Bridge	83
LIST OF APPENDICES	
APPENDIX A. HISTORICAL AND ARCHAEOLOGICAL RESOURCES	
APPENDIX B. HYDROLOGIC AND HYDRAULIC ANALYSIS	
APPENDIX C. GEOTECHNICAL ANALYSIS	
APPENDIX D. PERTINENT CORRESPONDENCE	
APPENDIX E. INCREMENTAL ANALYSIS	
APPENDIX F. PRELIMINARY COST ESTIMATES	
APPENDIX G. REAL ESTATE REQUIREMENTS	
APPENDIX H. SEDIMENT CHEMISTRY ANALYSIS	
APPENDIX I. SITE EVALUATION	
APPENDIX J. BATHYMETRIC ANALYSIS AND RESULTS	
APPENDIX K. WATER QUALITY	
APPENDIX L. ESSENTIAL FISH HABITAT	